U.S. Department of Transportation

Federal Aviation Administration

FAA Northwest Mountain Region
17900 Pacific Highway South
C-68966
Seattle, Washington 98168

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Designee Newsletter

Aircraft Certification Division
Transport Airplane Certification Directorate

U.S. Department of Transportation
Federal Aviation Administration

DESIGNEE NEWSLETTER

Charles R. Foster
Director
Transport Airplane Certification Directorate

Leroy A. Keith
Manager
Aircraft Certification Division

R. Jill DeMarco
Editor

Monica M. Burgess
Typist

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About The Cover

BOEING MODELS 757 AND 767

The decision to seek a common type rating for both the B-767 (type certificated July 30, 1982) and B-757 (type certificated December 21, 1982) led to an FAA effort over a 2-year period to analyze and test the suitability of a single rating for pilot qualification to fly each of these aircraft.

The common type rating program was a thorough and very successful one. The FAA is confident that the common type rating will be successfully applied by the air carriers in the near future.

For an in-depth look at this program, see the "Special Topic" feature elsewhere in this edition.

[Our thanks to The Boeing Company for providing the cover photo.]

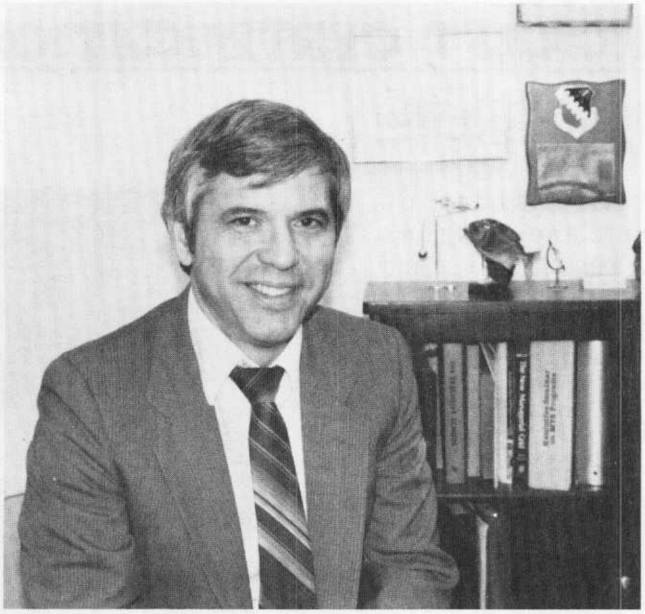
Notes from the Editor

If you would like a copy of any of the previous editions of the Transport Airplane Certification Directorate's Designee Newsletter, please submit your request to:

Editor, Designee Newsletter
Federal Aviation Administration
Northwest Mountain Region
Aircraft Cert. Division, ANM-103
17900 Pacific Highway South, C-68966
Seattle, Washington 98168

Any comments, questions, or suggestions you might have concerning this edition may also be directed to the above address.

Dear Designee:



**Leroy A. Keith, Manager,
Aircraft Certification Division**

Over the last year, the FAA has experienced severe budget cuts that have impacted every facet of our organization. We have had to prioritize the funding of all the services which we have committed to provide to the public. Unfortunately, these budget cuts have impacted the Designee Newsletter, and we now find that funds previously allocated for compiling, publishing, and distributing the Newsletter are no longer available. With regret, this will be our concluding edition. We are optimistic that our future budgets may be such that funding for the Newsletter will be provided and that we will be able to revive this publication. However, at present and through the remainder of this fiscal year, that funding is unobtainable.

I am confident that this Newsletter has, in many ways, served its intended objective as a means to keep Designees abreast of regulatory activity, new guidance material, technical issues, and Directorate activities. I thank you for your support, interest, and contributions to the Newsletter during these last two years.

In the meantime, I encourage you to continue to maintain close working relations with our personnel at your local Aircraft Certification Offices and to continue to participate in their scheduled Designee conferences. The capacity in which you, the Designee, represent the Administrator and the FAA is reliant on your knowledge of up-to-date technical and policy issues. As you know, the Designee conferences have clearly proven to be a worthwhile means of exchanging new information and keeping valuable communications lines open between us.

Thanks again for your continuing support in the pursuit of excellence in civil aviation.

Leroy A. Keith

Leroy A. Keith

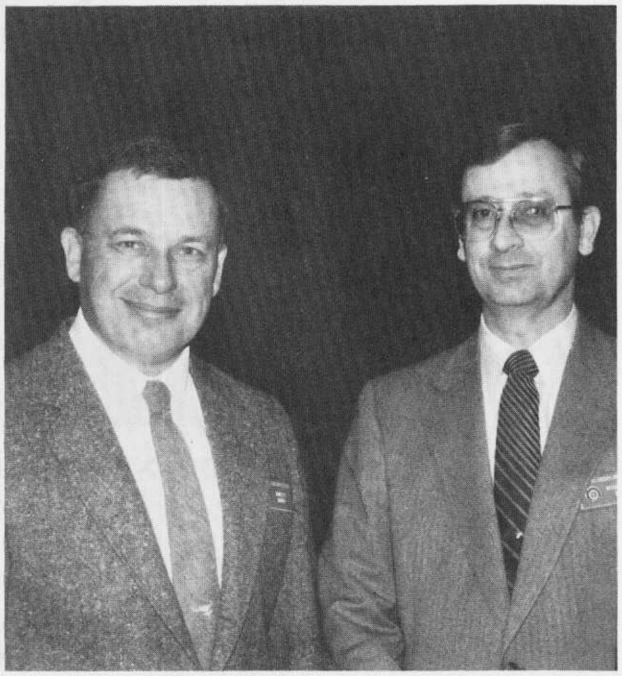
Office Profile:

DENVER AIRCRAFT CERTIFICATION OFFICE

The Denver Aircraft Certification Office (ACO) administers and ensures compliance with agency regulations and standards governing the type design, production, and original airworthiness of aircraft, aircraft engines, and propellers in the states of Colorado, Utah, Wyoming, and Montana.

Located at the south end of Stapleton International Airport, the Denver ACO presently has 11 employees on board: Woodford R. (Woody) Boyce, Manager; 6 Aerospace Engineers; 1 Flight Test Pilot; 2 Aviation Safety Inspectors; and 2 Aircraft Certification Assitants.

JACQUELINE BAKKER
Aircraft Certification Assistant



JIM CHUDY (left), Aerospace Engineer and Denver ACO DER Coordinator; and WOODY BOYCE, Manager

The wide diversity of modification projects handled by the Denver ACO is evident when reviewing just a few examples of some currently in progress: installation of extended-range fuel tanks on the Cessna Citation III, Gates Learjet Model 53, and Mitsubishi MU-3000; helicopter and balloon modifications; design approval of parts for old aircraft; NAV systems modifications; aircraft seat and baggage compartment modifications; and an STC for hand-controlled rudders for use by handicapped individuals.

On January 24-25, 1985, the Denver ACO held its 7th Annual DER Conference. Hosted by Woody Boyce and Jim Chudy

The FAA Panel: (l. to r.) WOODY BOYCE, Manager; ROMAN GABRYS, Airframe; DAVE GROSSMAN, Systems; STAN WELLES, Airframe; TERRILL MALLECK, Systems

(Flight Test Pilot and DER Coordinator), the goal of the conference was to provide Designees with information of current certification programs; to give a preview of certification standards currently in the works; to provide a glimpse of new technology relevant to the aviation industry; and to provide a forum for Designees to ask questions, to provide input, and to vent.

Guest speakers at the conference were Alan Price (DER) and Jim Treacy (FAA's National Resource Specialist for advanced avionics).

Mr. Price, a DER since 1947 and former Vice President and General Manager at Lear Fan, gave a comprehensive overview of the progress of the Lear Fan Model 2100 certification program.

Mr. Treacy presented a review of recent developments in avionics -- Electronic Flight Instrument Systems (EFIS), LORAN-C Navigation Systems, and Microwave Landing Systems (MLS). He also addressed recent policy issues concerning each of these systems.

CAMILLA VOGL
Aircraft Certification Assistant

Advisory Circulars (AC)

AC 20-121, AIRWORTHINESS APPROVAL OF AIRBORNE LORAN-C SYSTEMS FOR USE IN THE U.S. NATIONAL AIRSPACE SYSTEM, was issued August 23, 1984). It establishes an acceptable means of obtaining airworthiness approval of airborne Loran-C navigation systems for use under VFR and IFR as an area navigation system within the conterminous U.S., Alaska, and surrounding U.S. waters.

AC 20-122, ANTI-MISFUELING DEVICES: THEIR AVAILABILITY AND USE, was issued October 5, 1984. In order to curb accidents resulting from misfueling gasoline aircraft with jet fuel, this AC describes the use of special fuel tank adapters and fuel nozzles designed to prevent such mishaps. In addition, the agency has issued a final rule which allows pilots under most circumstances, to install the gas tank adapters themselves and not have to wait for a mechanic to do the job.

The adapter reduces the size of the tank opening so that the special jet fuel nozzles will not fit. FAA also is teaming up with various aviation organizations to stem the increase of these accidents. For example, as a result of the efforts of the General Aviation Manufacturers Association, manufacturers are already building planes with smaller fuel tank openings.

AC 21-16B, RADIO TECHNICAL COMMISSION FOR AERONAUTICS DOCUMENT NO. DC-160B was issued October 9, 1984. This AC calls attention to the RTCA Document No. DO-160B, "Environmental Conditions and Test Procedures for Airborne Equipment," dated July 20, 1984, and discusses how the document may be used in connection with TSO authorization.

AC 25.629-1, FLUTTER SUBSTANTIATION OF TRANPORT CATEGORY AIRPLANES, was issued by the Northwest Mountain Region Aircraft Certification Division on January 4, 1985. As noted in the last edition of the Designee Newsletter, this AC describes a means of demonstrating compliance with the regulations concerning design requirements for transport category airplanes to preclude flutter and other aeroelastic phenomena.

AC 25-XX, AUXILIARY FUEL SYSTEM INSTALLATIONS. This AC sets forth acceptable means, but not the sole means, by which compliance may be shown with auxiliary fuel system installation requirements in accordance with specified Federal Aviation Regulations. A Notice inviting public comment on this AC was published in the Federal Register on April 1, 1985 (50 FR 12886). The comment period closes July 1, 1985.

AC 25-939-XX, EVALUATING TURBINE ENGINE OPERATING CHARACTERISTICS, is a proposed AC which provides guidance for the evaluation of turbine engine (turbojet, turboprop, and turboshaft) operating characteristics. A Notice inviting public comment on this AC was published in the Federal Register on January 7, 1985 (50 FR 913). The comment period closed March 25, 1985.

AC 25-994-XX, FLAMMABLE FLUID COMPONENTS AFFECTED BY WHEELS-UP LANDING. This purpose of this proposed AC is to provide some guidelines and installation practices which, if used, will comply with the intent of the applicable rule. A Notice announcing the availability of the proposed AC and requesting public comment was published in the Federal Register on January 10, 1985 (50 FR 1293). The comment period closed April 10, 1985.

Proposed Rules

SPECIAL REVIEW: TRANSPORT CATEGORY AIRPLANE AIRWORTHINESS STANDARDS. On September 21, 1984, the Acting Director of the Northwest Mountain Region signed Notice of Proposed Rulemaking (NPRM) No. 84-21. This Notice announced the FAA's intent to amend the airworthiness standards conatined in FAR Part 25 applicable to transport category airplanes to:

1. Update Part 25 for clarity and accuracy;

2. Ensure the airworthiness standards are practicable for the light transport airplanes common to regional air carrier operation; and

3. Relieve the regulatory burden wherever possible.

This Notice appeared in the Federal Register on December 4, 1984. The comment period closed April 4, 1985.

IMPROVED FLAMMABILITY STANDARDS FOR MATERIALS USED IN THE INTERIORS OF TRANSPORT CATEGORY AIRPLANE CABINS. On April 8, 1985, the Director of the Northwest Mountain Region signed NPRM No. 85-10. This Notice announces the FAA's intent to upgrade the fire safety standards for cabin interior materials in transport category airplanes by: (1) establishing new fire test criteria for type certification; (2) requiring that the cabin interiors of airplanes manufactured after a specified date and used in air carrier service comply with these new criteria; and (3) requiring that the cabin interiors of all other airplanes type certificated after January 1, 1958, and used in air carrier service comply with these new criteria upon the first replacement of the cabin interior. This Notice appeared in the Federal Register on April 16, 1985. The comment period closes July 15, 1985.

TECHNICAL STANDARD ORDERS (TSO)

The Office of Airworthiness in FAA Headquarters recently issued the following TSO's to reflect technological advances in aeronautics:

TSO-C23c: Personal Parachute Assemblies

TSO-C26c: Aircraft Wheels and Wheel-Brake Assemblies, with Addendum I

TSO-C31d: High Frequency (HF) Radio Communications Transmitting Equipment Operating Within the Radio Frequency Range of 1.5-30 Megahertz

TSO-C32d: High Frequency (HF) Radio Communications Receiving Equipment Operating Within the Radio Frequency Range of 1.5-30 Megahertz

TSO-C-34d: ILS Glide Slope Receiving Equipment Operating Within 328.6 to 335.4 Megahertz

TSO-C62c: Aircraft Tires, with Addendum I

TSO-C105: Optional Display Equipment for Weather and Ground Mapping Radar Indicators

To obtain a copy of any of the TSO's listed, write to: Federal Aviation Administration, Office of Airworthiness, Aircraft Engineering Division (AWS-100), 800 Independence Avenue, S.W., Washington, D.C. 20591.

Indicate in your request whether you desire to have your name placed on the mailing list to receive future issuances of the TSO's, notices for public comment on proposed TSO's, or copies of proposed TSO's.

NOTICES AND DIRECTIVES

Notice 8000.253: Designated Airworthiness Representatives Program Adjustments, (issued 11/7/84).

Notice 8320.304: Part 121 and 135 Air Carrier Transport Category Aircraft Corrosion, (issued 10/9/84)

Notice 8320.305: Phosphate Ester Based DMS-2014 Hydraulic Fluid Leaks, (issued 10/19/84).

Notice 8320.306: Bell 206A and B Helicopter Inspection for Cracked Pilot Valve Actuator Sleeves, (issued 10/19/84).

Notice 8320.307: DC-9 Series Airplanes Engine Driven Generators, APU Generator, and APU Start, Power Feed Cables, (issued 10/25/84).

Notice 8320.308: Lockheed L-1329 Series Aircraft (Jetstar I and II) Empennage Pivot Fitting Assembly, (issued 11/1/84).

Notice 8320.309: Approval of Approved Aircraft Inspection Programs (AAIP), (issued 11/13/84).

Notice 8600.40: Use of Liability to Influence Compliance with Manufacturer's Recommendations, (issued 11/5/84).

New Faces

BILL R. BOXWELL

Bill Boxwell was recently selected as Manager of the Policy and Procedures Branch, an integral part of the Aircraft Certification Division's Transport Standards Staff. A graduate of California State Polytechnic University and Golden Gate University, he joined the FAA as a flight test engineer in 1978.

Prior to that, he served as project engineer/manager at the Air Force Flight Test Center (Edwards AFB) and was responsible for the flight test evaluation of USAF jet aircraft (including the YF-17 and F-111). Mr. Boxwell was also employed by the Boeing Company, where he was involved in the FAA certification of the B-727-200 and the evaluation of the Boeing 727-100 on gravel runways.

His most recent work with FAA has, among other things, involved him in two major projects: the development of a new policy to standarize the accelerate-stop methodology among jet transport manufacturers; and the review and rewriting of the FAA Flight Test Guide.

General News:

FAA HELPS AIRLINERS TAKE THE HEAT

The agency has issued a Notice of Proposed Rulemaking (NPRM) that aims to make cargo and baggage holds on future airliners better able to contain fires.

Tests conducted at the FAA Technical Center under authentic fire conditions suggest that flames could burn rapidly through certain liner materials that meet current standards for transport aircraft. The testing also revealed that the intensity of a cargo compartment fire is influenced more by the size of the compartment than by the airflow leakage.

Accordingly, the NPRM would require new, more realistic testing procedures for gauging the flame penetration resistance of liner materials. At present, a simple Bunsen burner test is used.

The proposal also would limit the maximum volume of Class D cargo compartments to 1,000 cubic feet, thereby keeping the size of the hold and the amount of oxygen they contain to levels that are safely within the capabilities of their liner materials. ††

FIRE SAFETY RULES ISSUED

The FAA has adopted two major safety regulations designed to give airline passengers more time to escape burning planes and find exits in smoke-filled cabins.

The first calls for air carriers to install slower-burning seat coverings that meet stricter flammability standards. It applies to transport planes weighing 12,500 pounds or more or those with 30 or more seats. Airlines have three years to bring these airplanes into compliance.

FAA researchers say that the seat covering rule could delay the "flashover" point in cabin fires for as much as 40 seconds, giving passengers and crew precious extra time for evacuation and greatly increasing the chances for survival. "Flashover" refers to the point where flammable vapors trapped near the cabin ceiling suddenly ignite the length of cabin, consuming oxygen and creating a deadly inferno.

The second rule mandates new emergency escape path markings or lighting near the floor to guide passengers to exits when overhead emergency lighting is blocked out by smoke. The deadline for compliance is two years. ††

PORTABLE COMPUTERS TO BE ALLOWED ON PLANES

Airline passengers will soon be allowed to play their electronic games or work with computers and calculators except during takeoffs and landings. FAA decided to change its rules after a series of tests found no evidence that the operation of these devices interfered with aircraft communications or navigation equipment.

Besides these tests, which were conducted by FAA and a private technical study group, the agency has investigated isolated reports of interference from portable computers over a period of several years and has not found one repeatable or confirmed case of such interference.

The present FAA regulation (FAR 91.19) prohibits the operation of portable electronic devices on aircraft, except voice recorders, hearing aids, heart pacemakers, and electric shavers.

FAA now plans to issue a Notice of Proposed Rulemaking to amend the regulations and to add computers, calculators, and electronic games to the list of approved items. Also, FAA will publish an Advisory Circular (AC) telling the public of its findings. ††

General News Continued...

CID PRODUCES VAST DATA

Five years of planning for the "Controlled Impact Demonstration" (CID) came to an abrupt end at Edwards AFB at 9:23 (PST) on December 1, 1984, when a four-engine Boeing 720 was intentionally flown into the ground to collect data on various crashworthiness and fire safety experiments.

The remotely-controlled flight lasted a little over nine minutes, with the aircraft climbing to 2,300 feet before turning to begin its descent into a prepared impact area. The flight went flawlessly until the very end when NASA test pilot Fitzhugh Fulton reported some last second "oscillation" of the wings that altered the impact scenario.

Although the post-impact fire raised questions about antimisting kerosene (AMK), Jim Woodall of the FAA's Technical Center took an optimistic view. "We are very apt to learn more because the test didn't go exactly as expected than we would have otherwise," he said.

Woodall also emphasized that all of the data from the various crashworthiness experiments on board the airplane had been radioed to ground recorders and should prove immensely useful in improving future aircraft design, structures, and safety systems. He noted that the instrumentation in the Boeing 720 continued to transmit data for 10 minutes after impact.

Since 1978, the FAA has been conducting a program to assess the technical and economic feasibility of the use of antimisting agents in Jet-A kerosene to attempt to reduce the number of fire deaths that occur in impact-survivable commercial transport crashes. The antimisting additives are intended to prevent the formation of fine fuel-mist droplets that usually result when aircraft tanks are ruptured during such crashes. The antimisting agents being investigated are high molecular weight, long chain polymer hydrocarbons that are dissolved in the Jet-A fuel using a glycol/amine carrier fluid. Once in solution, these additives suppress the tendency of the fuel to break up into fine mist droplets, and in that way, either make ignition improbable, or the propagation of any ignition that does occur through the coarser field more difficult.

The impact scenario of the CID demonstrated that there are conditions where adding an antimisting characteristic to jet fuel is not sufficient to prevent a post-crash fire. Specifically, the destruction of an engine produced an intense ignition source near the leading edge of the wing at the point of fuel release. While the antimisting characteristics of the fuel may have prevented forward propagation of the fire had the fire source been further aft, it provided limited protection in the CID scenario. Any future course of action by the FAA in regards to AMK has not yet been determined.

However, FAA Administrator Don Engen told a television interviewer that although the AMK had not performed exactly as anticipated, "I think the fire would have been greater had the fuel not contained AMK." ††

B-737-300 CERTIFICATED

The Northwest Mountain Region certificated the Boeing 737-300 on November 14, 1984, after a flight test and inspection program that lasted a little over four years. Over 350 hours were flown by FAA pilots for certification purposes.

Boeing has announced that it already has orders for 155 of the larger, faster, quieter, and more economical jet transports. ††

UPDATE ON ETOPS

A notice of availability of draft Advisory Circular 120-xx concerning "Extended Range Operation with Two-Engine Airplanes" (ETOPS) was published in the Federal Register on February 6, 1985. The draft AC was available for public comment through March 8, 1985. It contains proposed criteria which airplanes must meet before receiving FAA approval for making transoceanic passenger flights in two-engine jet aircraft.

It must be assured that approved operations of the two-engine extended range flights will be consistent with the same level of safety required for the current extended range operations of three- and four-engine turbine powered airplanes. FAA will require airlines wishing to make such flights to prove individually that the carrier, its aircraft, and its flight crew members meet the criteria.

Under these criteria, authorized airlines will be permitted to fly routes that are within 20 minutes of one-engine flying time from an adequate airport, provided that at least half this route is less than 90 minutes of one-engine flying time from such an airport. The current standard is 60 minutes. Granting approval for certain twin engine airplanes to operate extended range will most certainly increase the utilization and scope of operation of these airplanes.

Besides engine reliability, the proposed criteria cover such items as special airframe reliability, backup systems, maintenance, fire protection, and crew training.

Airlines meeting the criteria will be authorized to fly the traditional North Atlantic routes, but not the West Coast to Hawaii route.

Currently, the only aircraft for which approval has been sought to fly under the new criteria is a version of the Boeing 767 ER (Extended Range).

It should be noted that this draft AC deals with a relatively new concept: The basis for establishing a suitable type design and operation is the ability to achieve and maintain a desired level of reliability. The FAA will be thoroughly scrutinizing and evaluating the data and methods used to establish reliability. ††

TCAS II CONTRACTS AWARDED

The FAA has awarded two contracts, each valued at $5.5 million, for 16 Traffic Alert and Collision Avoidance Systems (TCAS II) that will be installed and tested in airline and FAA aircraft.

The contracts went to the Bendix Corporation, which will provide seven TCAS II units, and to the Dalmo Victor Division of Bell Aerospace/Textron, which will produce nine. FAA will receive two systems from each manufacturer, with the remainder to be used in the airline evaluation program.

Under the program, Bendix will work with United Airlines while Dalmo Victor is teamed with Piedmont and Republic Airlines in order to establish industry-wide operational confidence in the new equipment.

TCAS II is intended to serve as a back-up to the air traffic control system by alerting pilots to potential midair collisions and telling them what evasive action they should take to avoid another aircraft.

The 16 units now under contract will provide only vertical collision avoidance instructions, but the FAA is continuing its work at the Technical Center to develop an enhanced version that will provide horizontal escape commands as well. ††

STC APPLICANT'S RESPONSIBILITY
RELATIVE TO SUBSTANTIATION DATA,
DRAWING PACKAGES, AND CONFORMITY

As a reminder to Designees, the regulatory basis for supplemental type certificate (STC) projects is as follows:

GENERAL: FAR 21.113 and 21.115
SPECIFIC: FAR 21.31, 21.33, and 21.53

On any major aircraft modification, it is the responsibility of the applicant to demonstrate to the FAA that the modified aircraft meets the same rules as it did when it was manufactured or the rules currently in effect.

Any design data used to demonstrate compliance must be created or developed by the applicant or his representative. Once these data are complete, they are submitted to the FAA for review and approval.

Because of limited staffing and an increased workload, the FAA cannot act as a data and/or drawing checker. If any significant mistakes are discovered, the data package will be returned to the applicant for rechecking and resubmittal. The FAA will not be able to mark specific corrections for each mistake, and the burden will be on the applicant to do the necessary work in preparation for FAA approvals.

Should the applicant decide to utilize the services of a Designated Engineering Representative (DER), the extent of direct FAA involvement may be significantly reduced, eliminating costly program delays.

It is the responsiblity of the applicant or the DER (if involved), in accordance with FAR 21.33(b), to accomplish the following before submitting design data to the FAA for review and approval:

1. Check and recheck all substantiation data, drawings, top drawing lists, etc., for completeness and correctness of information on detail parts, materials, assemblies, and installation details; and

2. Determine that the design data and the modified aircraft meet the applicable CAR/FAR (FAA verifies this finding).

After the design data have been accepted by FAA engineering, FAA inspectors conduct a conformity inspection. Prior to submittal of the article or aircraft for FAA conformity inspection, the applicant must:

1. Conduct his own conformity inspection to ensure that the product was manufactured in accordance with, and conforms to the substantiation data and final drawings; and

2. Sign a "Statement of Conformity," FAA Form 8130-9 (old Form 317), certifying that the applicant has conducted a conformity inpsection and that the product, as presented to the FAA, conforms to the design data and drawings. Any deviations for the substantiation data and drawings must be listed on the Form 8130-9 (reference FAR 21.53). In addition, the conformity inspection requires that the applicant certify that the original aircraft, except as affected by the modification, conforms to its type design.

NOTE: Substantiation data includes static, dynamic, and flight test proposals and results; and analyses, references, weight and balances, processes, procedures, etc. ††

FAA PROPOSES UPGRADED RECORDERS ON OLDER JETS

The FAA has proposed a new rule requiring the installation of more sophisticated flight data recorders on approximately 2,000 older jet aircraft. The aircraft primarily affected would be the Boeing 727, Boeing 737, and McDonnell-Douglas DC-9. The new equipment, known as digital flight data recorders, would be of great value in the investigation of aircraft accidents because the information can be retrieved from them more quickly and easily than from older equipment. In addition, the eventually would be required to record more kinds of information than those they will replace.

The proposed regulation also would require that certain jet and turboprop commuter aircraft be equipped with cockpit voice recorders that tape pilot conversations and other sounds for accident investigation use. The affected airplanes would be those that carry six or more passengers and which are required to have two flight crewmembers. Existing regulations require this equipment only on jet commuter aircraft with 10 or more passenger seats. The regulation would require that existing aircraft type-certificated before September 30, 1969, be equipped with digital (as opposed to foil-type) flight data recorders, capable of recording six types of information, within 2 years of the effective date of the regulation. They would have to be upgraded to record 11 different types of information within 7 years. New aircraft produced under a type-certificate issued prior to September 30, 1969, would be required to have installed digital flight data recorders capable of recording 17 types of information.

The proposed regulation was published in the Federal Register on January 8, 1985. The closing date for comments was March 2, 1985.

††

DAMAGE TOLERANCE ASSESSMENT OF SYSTEMS AND EQUIPMENT INSTALLATIONS

The damage tolerance and fatigue evaluation of structure required by FAR 25.571 is generally applied only to primary structure as defined in AC 25.571(c), "Damage Tolerance and Fatigue Evaluation of Structure" (published 9/28/78).

However, other primary load carrying elements should be evaluated for damage tolerance/fail-safe design if a safety analysis shows that failures in these elements could contribute to a catastrophic conditions. Fittings and fasteners attaching system components and equipment installations to primary structure should be assessed for failure conditions which could be catastrophic. The evaluation should consider: damage to other essential systems, fire hazards, controllability, freedom from flutter, etc.

The application of fail-safe, safe-life, or damage tolerance evaluation of these load carrying elements should be consistent with the original certification basis.

The residual strength requirements of FAR 25.571 paragraph (b) or (e), depending on detectability, should be applied to the installation with the assumed damage. Also, the airplane maintenance inspection program should include those parts which could contribute to a catastrophic failure condition. ††

APU INSTALLATION CRITERIA

The auxiliary power unit (APU) compartment is designated as a fire zone in accordance with FAR 25.1181(a)(4). The compartment (fire zone) must meet the requirements of FAR 25.1185 through 25.1206. In addition, compliance with APU inlet requirements of FAR 25.1091 through 25.1105 must be accomplished. In light of these requirements, partial shrouding of the APU becomes a very difficult design to accomplish for the intent of rule.

FAR 25.1191 states that the APU must be isolated from the rest of the airplane by firewalls, shrouds, or equivalent means. FAR 25.1191 requires complete enclosure if an equivalent has not been offered for evaluation.

Regarding rigid or flexible fire extinguisher lines, service experience can be used to encourage an applicant to utilize some other means to ensure reliability of their design. However, rules do not specify preference for rigid vs. flexible. The Northwest Mountain Region has accepted flexible lines if properaly qualified and installed. ††

LANDING GEAR BREAKAWAY REQUIREMENTS

The landing gear breakaway requirement of FAR 25.721(a) was made effective by Amendment 32. This rule requires that "...if [the landing gear] fails due to overload...", hazardous fuel spillage will be prevented. There have been proposals to design to specific overload conditions such as 15 ft/sec. descent velocity.

There is no specific overload specified by the rule. The landing gear must be considered subjected to any combination of up and aft loads (at any magnitude) that will cause failure. Hazardous fuel spillage must be prevented by proper shearing or other means.

It is not considered acceptable to show compliance by demonstrating that the gear will not fail under specific overload conditions. ††

MORE ON CERTIFICATION OF VERTICAL DESCENT FLIGHT MODES

In a previous article, "Certification of Vertical Descent Flight Modes in Transport Category Aircraft" (Designee Newsletter; Edition 2; page 12), information was provided concerning procedures used to preclude aircraft overspeed resulting from automatic transitions of the aircraft from the cruise to the vertical descent/ascent flight mode initiated by pre-programmed features in the flight management guidance system. The guidance which was presented in the referenced article has been generally adopted; however, the following is provided for additional clarification on ways used to meet the intent of the recommended procedures.

1. Adequate annunciation of an impending automatic departure from a cruise altitude should be provided for all systems having vertical navigation (VNAV) modes. Examples of adequate annunciation are: systems that display the aircraft position and top of descent/bottom of climb point continuously, as in a HSI map mode; or systems that provide a dedicated display of distance to the top of descent/bottom of climb point or other separate and unique annunciation of "vertical waypoint alert" displayed in the pilot's primary field of view.

2. VNAV systems that can automatically capture a pre-programmed vertical profile do not require a separate pilot action to activate the decent/climb at

top of descent or bottom of climb point, provided both the following conditions are satisfied:

A. The VNAV system is integrated with the altitude selector in such a manner that a transition to descent or climb will not occur unless the altitude selector has been appropriately set by the pilot.

B. The VNAV system contains system design features that provide overspeed/underspeed protection.

3. VNAV systems which do not comply with the criteria of paragraph 2, above, should require timely overt action (within 5 minutes) of top of descent/bottom of climb point, in order for the VNAV system to automatically capture a pre-programmed vertical flight path. ††

CERTIFICATION OF NON-REQUIRED, NON-ESSENTIAL EQUIPMENT IN TRANSPORT CATEGORY AIRCRAFT

It has been requested that more guidance be provided regarding FAA requirements for the installation of non-required, non-essential equipment, such as video projection systems, cathode ray tube entertainment systems, telephones, and stereo systems, in transport category aircraft.

The following information describes test and installation requirements which should be used for transport category aircraft:

1. Verify by analysis and/or test the structural integrity of equipment installations for the critical loading condition: flight, ground, or emergency landing. Verification by test must be accomplished to an FAA-approved test plan, on FAA-conformed parts, and FAA-witnessed.

2. Because of the possibility of aircraft decompression, a means must be provided for either the automatic removal of power from all components containing cathode ray tubes (CRT) or the installation of a barometric switch for each component using a CRT, unless the high voltage circuits and components can be shown to be free of arcing under appropriate environmental tests specified in RTCA/DO-160A of January 1980, or equivalent tests approved by the FAA.

3. **Materials used** in non-electrical **components, or materials** external to the **metal enclosure** used for electrical **components, should meet:**

a. The pertinent airworthiness requirements that were in effect for an airplane at the time which the application for the type certificate was filed; or

b. The requirements of FAR 25.853, Amendment 25-32, effective May 1, 1972, for the B-747, DC-10, and L-1011 airplanes which were previously certified to the same requirements under Special Conditions.

For all of the flammability tests, there should be an FAA-approved test plan, FAA conformity, and FAA witnessing. This criterion applies only to materials installed in a compartment occupied by crew or passengers. Wire added to the aircraft should have an insulation grade equal to or better than that originally approved under the airplane type certificate, unless it is inside an enclosure which is sufficiently airtight that internal combustion cannot be sustained.

4. Electrical components are defined as those receiving electrical power from any source. Except where obviously impractical for such items as TV receivers, cassette players, etc., components should be housed in metal enclosures which either will contain an

General News Continued...

internal fire, or are sufficiently air-tight that internal combustion cannot be sustained.

5. Electro-Magnetic Interference (EMI) tests should be performed on the sub-subject equipment in accordance with RTCA/DO-160A of January 1980, or equiva-equivalent requirements approved by the FAA. The tests required in accordance with RTCA/DO-160A, paragraph 21.0, are conducted RF interference and radiated RF interference tests, both done to the category "Z" level. In addition, the evaluation should incluae a cockpit EMI survey with the subject equipment in operation. Ground EMI tests have consistently been found adequate for follow-on approvals of equipment types, irrespective of the aircraft model used for the initial approval. RF transmission devices, such as wireless telephones, should also be tested in respect to their transmission frequencies and harmonics.

6. Components incorporating CRT's should meet minimum X-ray radiation requirements of the Department of Health and Human Services; Food and Drug Administration and Bureau of Radiological Health document HEW Publication (FDA) 79-8035, part of code of Federal Regulations Title 21 Subchapter J, or later approved HEW publications; or FAA-approved equivalent requirements. Commercially purchased units should be a label attached that certifies compliance to the above. Units modified by the installer which remove shielding material from or around the CRT should be retested to the above requirements.

7. Implosion protection for CRT's should be verified in accordance with Underwriters Laboratories document UL 1418 (formerly 492.8), paragraphs 13.2 and 14.2, or later Underwriters Laboratories revisions or FAA approved equivalent requirements. Underwriters Laboratories labels that certify compliance to the above are attached to most U.S. and foreign manufactured CRT based appliances.

8. Wire and bundle identification should be in accordance with Advisory Circular 43.13-1A, "Acceptable Methods, Techniques, and Practices -- Aircraft Inspection and Repair" (published 4/17/72).

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FAILSAFE TAB CONTROL SYSTEMS

There have been continuing requests for guidance in showing compliance with the failsafe tab requirements of FAR Section 25.629.

Compliance with the freedom from flutter requirements of Section 25.629(d) for control surface tabs may be demonstrated by either a multiple load path tab design or by an adequately balanced tab with appropriate substantiation showing freedom from flutter with a single failure in the tab control system.

Recommendations for dual dual load path method

Compliance with the flutter failsafe failure criteria for trim tab systems may be shown by multiple load paths in the tab control system up to the point where the system is irreversible.

The multiple load path method would require an assessment of residual fatigue and static strength after the single failure to assure that the remaining assessment should include the establishment of a conservative inspection period and inspection method. This procedure is considered to be necessary in view of adverse service experience where both tab rods have failed. Section 25.601 provides an adequate regulatory basis included Amendment 45 to FAR 25; Section 25.571 provides a specific regulatory basis for this assessment.

The following criteria are recommended for evaluating the residual strength capability of the tab control system. These specific recommendations are based on the premise that the tab control rods are oval, adjacent to each other, and not easily inspectable for cracks. Other installations will have to be evaluated on their own merits.

(a) A loading spectrum must be established for the tab that includes high energy buffet from the propeller slip stream or from other sources. Flight strain measurements are recommended.

(b) One tab rod should be assumed to have a crack that has grown from an initial .005-inch initial quality flaw for one airplane lifetime under the loading spectrum in the unfailed configuration.

(c) With the opposite rod failed, the remaining rod [with the crack determined by (b), above] should be able to sustain limit load for two inspection intervals. The inspection being conducted to detect the initial failed rod.

(d) The inspection interval in (c) should be predicated on a crack growth under the load spectrum as applied to the failed configuration. That is, with one rod failed, the crack growth should be from the final crack length determined in (b) to a critical crack length capable of sustaining limit load.

Recommendations for balanced tab flutter analysis

The balanced tab method of demonstrating compliance is acceptable, provided the analytical technique is conservative, based on experimental data, and conducted by flutter analysts with considerable experience in tab flutter analysis. Tab flutter analyses are exceptionally complex and may be subject to considerable unreliability if the above provisions are not met.

It is essential that the steady aerodynamic hinge moments of the control surface and tab be determined from experimental data and the quasi-steady aerodynamic coefficients used in the flutter analysis be adjusted to match these experimental values at zero frequency. Although theoretical coefficients are higher and tend to reduce the critical flutter speed, they also provide a higher aerodynamic damping, and consequently may suppress the typical hump modes associated with control surface and tab flutter. Both theoretical and adjusted coefficients should be used since the flutter mode could be either speed-critical or damping-critical. Once the analysis has been conducted with the nominal experimentally adjusted values of hinge moment coefficients, the analysis should be conducted with parametric variations of these coefficients.

If the above recommendations are followed and the flutter clearance is marginal in either speed or damping for any of the analysis conditions, then further substantiation by test should be required.

Recommendations for balanced tab flutter tests

Either representative wind tunnel flutter model tests to V_D or flight flutter tests to the range critical speeds shown by analysis should be conducted if the analysis is marginal. The tab failure may be simulated by free play provided the free play is sufficient and the test can be conducted without the tab grounded at either limit. The location of the failure in the tab system should be selected with regard to the extent that tab control

General News Continued...

system components contribute to the tab balance and tab inertia. The critical combination of these values, as indicated by the analysis, should be evaluated.

MIL-A-8870A provides tab rotational free play limits below which the tab is considered irreversible. Since these are conservative limits, the free play established to simulate a free tab should be well above these limits. The tab and control surface should be rendered as friction free as possible and normal slop resulting from wear, deterioration, or manufacturing variability should be induced in the tab hinges along with the tab rotational free play.

The exact amount of tab rotational free play should be established for each specific case, depending on tab and control surface geometry. It should be well above the MIL-A-8870A limit of 1.15 degrees, sufficient to assure that the tab will float free at the test speed. Five degrees have been accepted on several occasions to represent a failed tab. Lesser values could be acceptable, provided adequate instrumentation were installed, to determine if the tab were free floating at the test speed.

Other single failure considerations

In addition to single failures in the tab control system, the failure of a tab supporting hinge should be considered under Section 25.629(d). This failure mode can result in a large reduction in tab rotational frequency, particularly when the tab rods are connected close to the failed hinge. This condition can be critical whether or not dual tab rods are used.

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ORGANIZATIONAL CHANGES IN TRANSPORT AIRPLANE CERTIFICATION DIRECTORATE

As a result of several in-depth studies and evaluations, the following changes in the organizational structure of the Transport Directorate were effective as of April 1, 1985. An organization chart follows, which outlines more clearly the changes described below.

1. The title of the Regulations and Policy Office (ANM-110) was changed to the Transport Standards Staff (ANM-110).

2. The title and the routing symbol of the Technical Support Group (ANM-105) was changed to the Technical and Administrative Support Staff (ANM-103).

3. The Interdirectorate Certification Branch (ANM-150L) in the Los Angeles ACO, and the Foreign Certification Branch (ANM-150S) in the Seattle ACO have been abolished. A new branch, the Standardization Branch (ANM-113), has been established in the Transport Standards Staff. This branch combines the functions previously assigned to the Interdirectorate and Foreign Certification Branches.

4. The Anchorage and Denver Aircraft Certification Field Offices (ACFO) were redesignated as Aircraft Certification Offices (ACO) and the managers report to the Division Manager (ANM-100). The routing symbols for the two offices have been changed to reflect the change in reporting authority. The new routing symbols for the Anchorage and Denver ACO's are ANM-100A and ANM-100D, respectively.

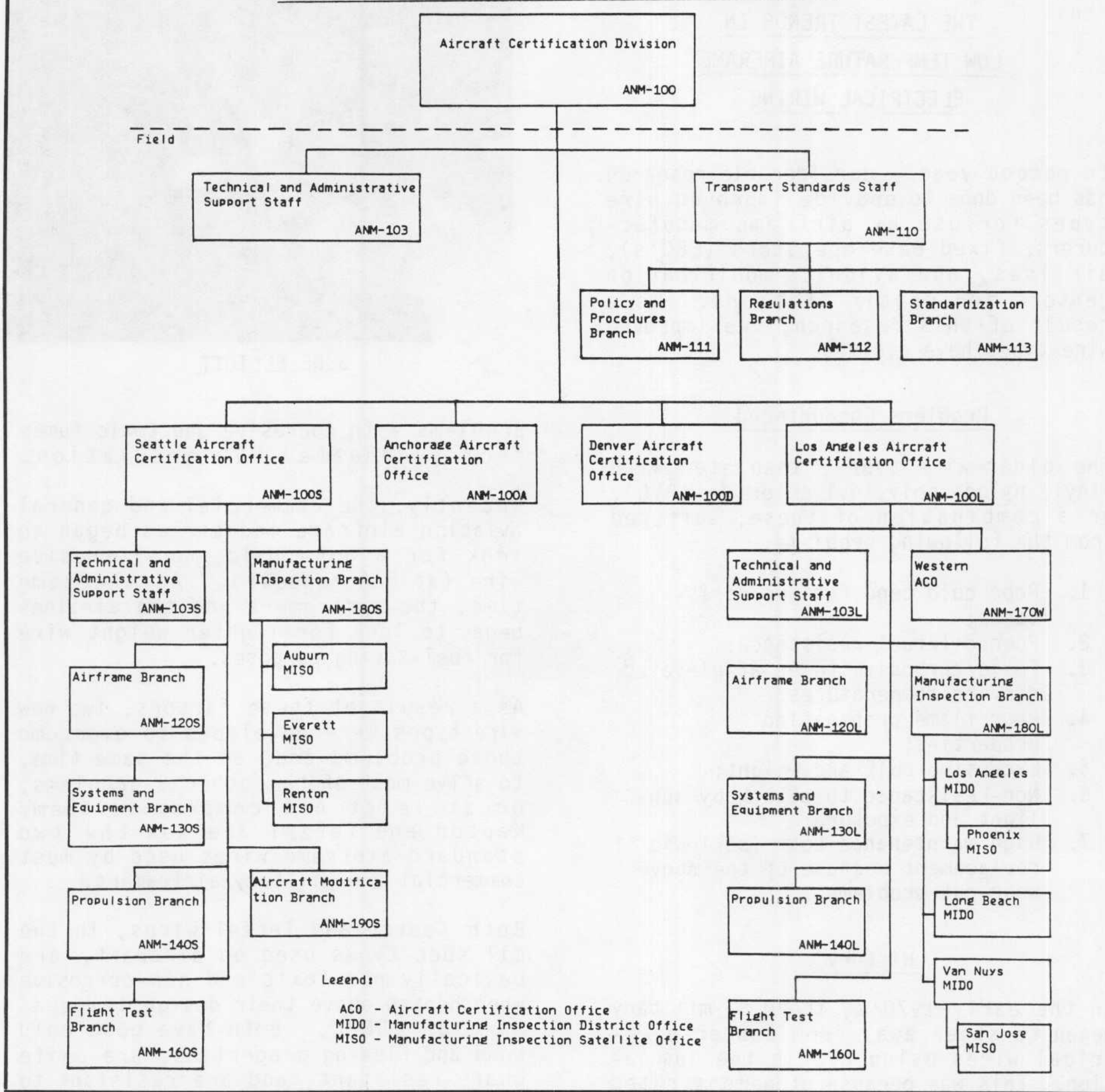
5. The titles and routing symbols for the following offices were also changed:

a. Technical Support Staff (ANM-104S), in the Seattle ACO, is now the Technical and Administrative Support Staff (ANM-103S).

b. Technical Support Staff (ANM-104L) in the Los Angeles ACO, is now the Technical and Administrative Support Staff (ANM-103L).

c. Technical Support Staff (ANM-171W) in the Western ACFO, is now the Technical and Administrative Support Staff.

TRANSPORT AIRPLANE CERTIFICATION DIRECTORATE



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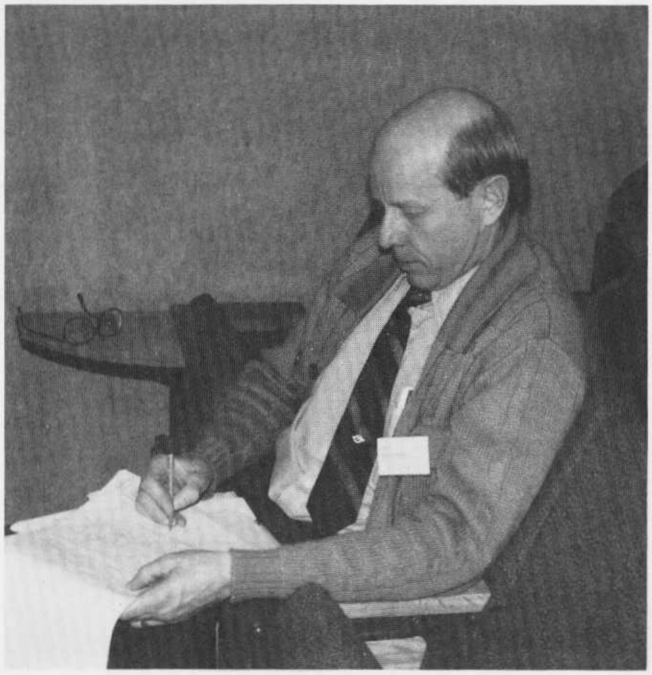

GENE ELLIOTT

[EDITOR'S NOTE: This article has been provided by Gene A. Elliott, Electrical/Avionics Engineer, Frontier Airlines; and DER.]

THE LATEST TRENDS IN LOW TEMPERATURE AIRFRAME ELECTRICAL WIRING

In recent years, considerable research has been done to provide improved wire types for use by airframe manufacturers, fixed base operators (FBO's), airlines, and avionics modification centers and repair stations. As a result of this research, two improved wire types have evolved.

Problems Encountered

The older wire types, insulated with vinyl, nylon, polyvinyl chloride (PVC), or a combination of these, suffered from the following problems:

1. Poor cold bend fatigue resistance;
2. Poor oil/fuel resistance;
3. Toxic/corrosive fumes at elevated service temperatures;
4. Poor flame propagation properties;
5. Excessive bulk and weight;
6. Non-resistance to attack by sunlight and exposure;
7. High maintenance cost (periodic replacement because of the above wear-out problems).

History

In the early 1970's, the U.S. military began to steer away from copper electrical wires using PVC in the insulation. This was because of demonstrated problems with corrosive and toxic fumes from overheated PVC insulation.

Recently, the commercial and general aviation airframe industries began to look for a non-toxic, non-corrosive wire (at FAA request). At the same time, the airframers and the airlines began to look for lighter weight wire for fuel-saving purposes.

As a result of these factors, two new wire types were developed to overcome these problems and, at the same time, to solve most of the other 5 problems, or at least not compromise them. Kapton and Tefzel are now the two standard airframe wires used by most commercial and military airframers.

Both Kapton and Tefzel wires, in the mil spec types used on aircraft, are basically non-toxic and non-corrosive when heated above their design temperature of 150°C. Both have good cold bend and flexing properties, are quite chafe-resistant, and are resistant to

Continued...

fuel and oil (including Skydrol hydraulic oil). In addition, both wire types easily meet the "self-extinguish" requirements of FAR 25, Appendix F.

Lower Size and Weight

Both Kapton and Tefzel wires can be built with very thin wall insulations without compromising ruggedness and wear-out characteristics. A 16-guage wire with one of these two insulations is of a smaller diameter than a 20-guage nylon/PVC wire. The latter (MIL-W-5086 Type II or a derivative of it) was the standard airframe wire for both commercial and military airplanes for many years. Of course, this reduction in size is accompanied by an attendant large reduction in weight. So great is this weight savings, that when Boeing switched to the new wire, over 165 lbs. of weight was saved on each Boeing 737 produced after late 1978!

Lower Maintenance Costs Possible

As far as cost is concerned, the initial installation cost of both Kapton and Tefzel wires will be higher because both types cost more than the earlier nylon/PVC wires. The new types may even cost more than some of the high temperature Teflon wires which have been, and still are, used quite successfully for jet engine control and indication circuits.

Total maintenance costs, or cost-to-own, could well be less for the new wires because of their potentially longer lives. For one thing, the old standard nylon/PVC wire was susceptible to deterioration caused by rays of ultraviolet light or sunlight. The new types of wire do not seem to be damaged by long term exposure to sunlight. They might, therefore, be used on retractable landing gear, for instance, providing that they are protected from braking heat and provided that proper clamping and routing is used.

Critical Installation Criteria

These new wire types are not completely without problems. Both Kapton and Tefzel in the 22-guage and smaller sizes, will require "special" crimp terminals and crimp tooling. If standard AMP crimp terminals are used, the insulation will not crimp properly. Due to the very small diameters of these types of wire, low tensile pull-out forces could result.

Wire identification marking will be more difficult in the smaller sizes, especially in the case of the Kapton because of its hard surface. The Tefzel can be reliably marked using the same Kingsley type, tape, temperature, and pressures previously used for high temperature Teflon.

One area that merits special attention when installing Kapton wiring is the potential for wire chafing or breaking if not carefully routed, conduited, and clamped. Because of its hard, almost brittle surface, large wire bundles of Kapton should not be installed in a tight bend, even if well supported. Kapton tends to fail if positioned in a tight bend over a long period of time. Also, even small bundles of Kapton should ideally be sheathed in heat shrink or plastic tubing when installed in metallic conduit. Under vibration, the Kapton can wear into aluminum conduit or tubing and short out if allowed to "ride" directly against the metal.

The Tefzel wire (part number M22759/16) is softer and more flexible, and does not seem to require such special installation techniques.

Both Kapton and Tefzel wires will, if properly installed, provide good, long-term service at a reasonable cost.

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SPECIAL TOPIC:

FAA EVALUATION: COMMON TYPE RATING B767/B757

EDITOR'S NOTE:

This article was provided by Thomas Imrich, Assistant Manager, Flight Standards Division, FAA, Northwest Mountain Region. The information was originally presented by him to several aviation news representatives on December 5, 1984, in Seattle, Washington, as part of an informal joint presentation by FAA, the Boeing Company, and Delta Airlines.

The decision to seek a common type rating for both the B-757 and B-767 aircraft led to an FAA effort over a 2-year period to analyze and test suitability of a single rating for pilot qualification to fly each of these aircraft.

The type rating is an endorsement placed on a pilot certificate which is a primary means used by the FAA and industry to manage pilot training, checking, and currency requirements. There are numerous references in aviation standards where the type designations are used. These range from pilot-in-command qualification, takeoff and landing recency of experience, and training requirements, to proficiency checks, and others. The type rating is one important means used to ensure adequate preparation of crews necessary to maintain flight safety.

There are well over 125 individual aircraft designations for which an FAA type rating has been established. The type ratings recognized by FAA are listed in the FAA's Advisory Circular system in AC 61-89A.

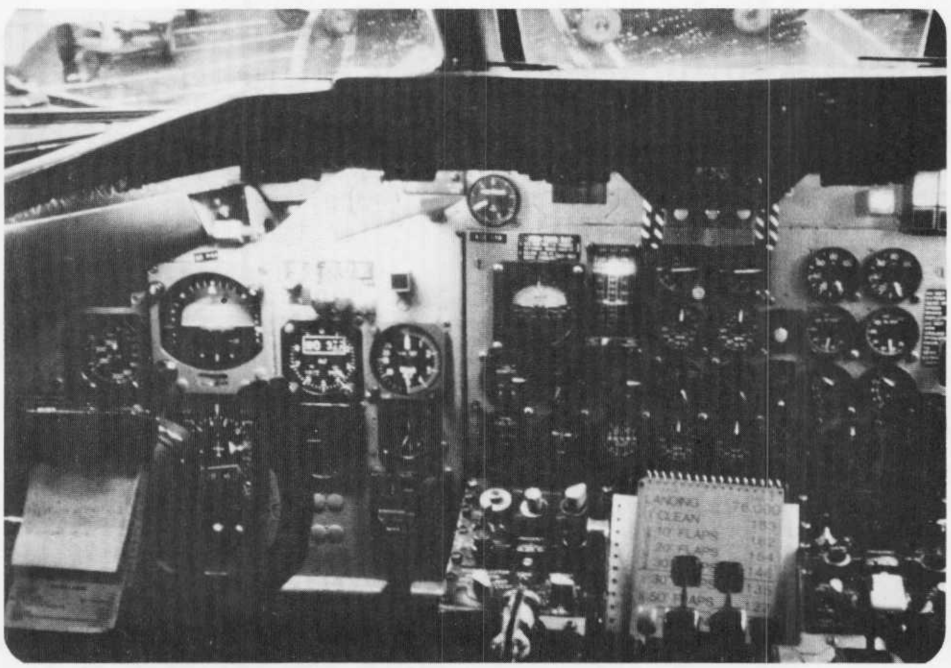
Some of these ratings may apply to various models of an aircraft type, in cases where the characteristics are sufficiently similar that a crew trained on one variation may safely fly the other. In such instances, a "same type rating" has been used. A significant example of this is with the DC-10 series of aircraft for which a single type rating has been established to apply to the DC-10-10, -30, and -40 models.

In a few instances there is sufficient commonality between different types of aircraft that a single type rating has proven adequate. Such was the case with the B-707, B-720, and KC-135, the CV-880/990, and the DC-6/DC-7 series of aircraft, for which the FAA determined that a "common type rating" was appropriate.

In designation of a type rating, the FAA considers variables such as the degree of cockpit commonality, crew duties and procedures, flight characteristics, aircraft characteristics of systems and powerplants, cockpit visibility, and flight envelope. The FAA and industry have considerable experience with the concept of a type rating, including use of "same" and "common" type rating dating back to the introduction of jet aircraft.

Special Topic Continued...

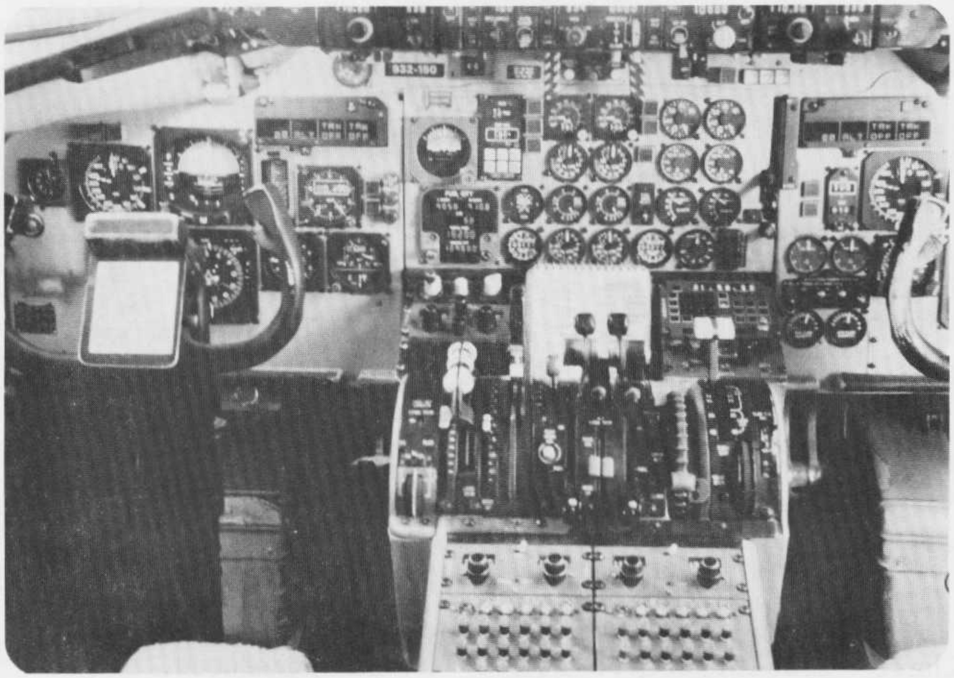
The DC-9-80 is a current production model of the DC-9 series, which included the earlier -10, -20, -30 and -50 models. These aircraft are being safely flown using a single type rating even though there has been considerable evolution of this cockpit since it was first introduced.



DC-9-10 COCKPIT

As an example of the similarity and differences between the DC-9 series, note the photograph of the cockpit of DC-9-10 introduced in the 1960's, and still in service. This cockpit view shows a configuration typical of aircraft designed in that period.

Special Topic Continued...



DC-9 SUPER 80 COCKPIT

In contrast, the DC-9 Super 80 has a cockpit which is considerably different from the DC-9-10 model of the aircraft, and somewhat different from other later versions. In the accompanying photo, one can see that the DC-9-80 has a different automatic flight control system, thrust management system, Category III landing capability, head up display, revised mode annunciation, and upgraded systems, such as pressurization and braking. Yet with each model, there has been sufficient commonality with earlier versions that a single type rating has been successfully used.

Based on previous experience with use of "same type ratings" with the DC-9, B-737, B-727, and other earlier series of aircraft, the FAA believed that there was a solid basis for evaluating the B-767 and B-757 to determine if a common type rating was appropriate.

The process used to evaluate a common type rating for the B-757/ B-767 was to:

1. Review previous experience, current applicable references, and criteria for type ratings;

2. Conduct a technical review of the proposed aircraft regarding their commonality and differences and the significance of each.

3. To review the aircraft individually through a flight and simulator evaluation program to determine if crews trained and checked on one model could safely fly the other.

The overall evaluation was conducted under the auspices of the FAA's B-757 and B-767 Flight Standardization Board. Flight Standardization Boards are the FAA's organizations which have the responsibility for setting training standards for each particular transport aircraft type. The Boards are comprised of selected FAA inspectors who

Special Topic Continued...

are highly experienced in both the particular aircraft type and in evaluating flight crew performance. The findings of Flight Standardization Boards are used by FAA offices around the country in the process of reviewing and approving particular airline programs.

Regarding the first item in this process, the definition of criteria, pertinent references were reviewed. This included: FAA internal orders relating to Airmen Certification; Federal Aviation Regulations, including Parts 61 and 121 regarding airmen practical tests, proficiency checks, and other standards; and Advisory Circulars, such as the type rating flight test guide.

Also established were test criteria for determining appropriate crew performance, criteria selection of candidate subjects, and qualifications for FAA evaluators.

Finally, test-specific issues, such as the role of safety pilots in the flight test program, were defined.

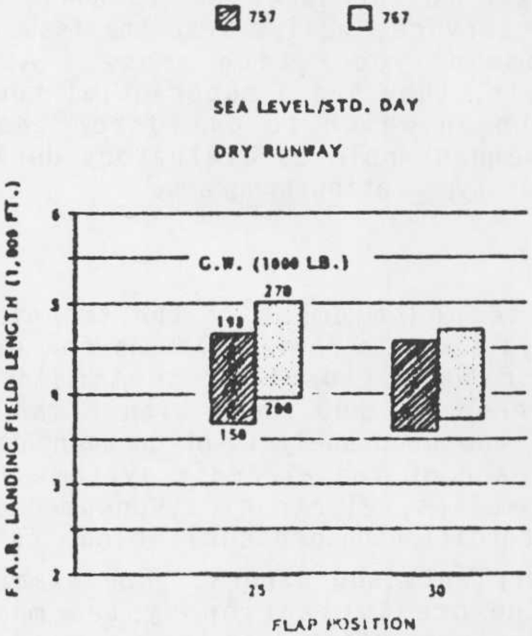
The FAA's technical analysis actually began early in the program, about the time the decision was made to use a common cockpit for both the B-757 and B-767. A nucleus of the Flight Standardization Board followed the aircraft through its design, development, and the FAA type certification process, and was quite familiar with the characteristics of each aircraft and issues that arose during testing. These individuals had experience with the certification program, including crew complement evaluation, function and reliability test programs, and issues related to introduction of aircraft into service, well before the issue of a common type rating arose. As a result, they had a substantial foundation on which to build for their subsequent role as evaluators during common type rating programs.

The second element of the technical analysis was to review systems for each aircraft to identify commonality, differences, and their significance. This included analysis of documentation for each of the aircraft systems for hydraulics, electronics, pneumatics, air conditioning pressurization, fuel, powerplants and others. For example, in the pressurization system minor differences existed on the two aircraft relating to the location of a cabin altitude warning light and a placard that specifies the maximum differential pressure for takeoff and landing. The differences in each instance were minor and not of operational significance.

The next phase of technical analysis included a review of procedures for the aircraft. The normal and non-normal procedures were reviewed for each aircraft and compared. For example, the non-normal procedures related to smoke removal for the B-767 and for the B-757 were examined. Our objective was to examine appropriate crew responses for each aircraft relating to memory items, local flow, and checklist compatability between the aircraft. We examined these items for evidence of negative learning transfer from one aircraft to the other and found no problems. We verified a high degree of commonality between procedures for these aircraft and the suitability of common memory response items.

Special Topic Continued...

757/767 LANDING DISTANCE



The performance characteristics of the aircraft were also considered. Shown is a diagram of the landing distance comparison between B-757 and B-767. The performance characteristics of the two aircraft were very similar. Our evaluation sought to ensure that a crew which was very familiar with the characteristics of one aircraft would not be adversely affected if only occasionally flying the other aircraft.

For example, if a crew were expecting a certain level of performance in landing on a limiting runway, or using high speed turnoffs, they would experience approximately the same level of performance with the other aircraft which might be flown less frequently.

In addition to takeoff and landing performance, other areas were compared, such as single engine climb performance, and normal climb and descent rates.

Technical analysis continued with the evaluation of the limitations of the aircraft, such as engine starting parameters, the use of reverse thrust, anti-icing, and operating weights. Our objective was to ensure that crews would not be confused between the use of different limitations, and that differences between all areas, including taxi, takeoff, maximum landing weights, and maximum zero fuel weights, were consistent with and no greater than differences found with other models of similar aircraft, such as the DC-9 or B-727 which crews routinely fly with a single type rating.

The overall concept of the flight evaluation process was to use crews trained in each aircraft respectively, and knowledgeable on only one aircraft, to fly the other without prior preparation for the opposite type of aircraft. This would ensure that aircraft in service could be safely flown. This evaluation was done with crews that were not trained or were not experienced in the new type of aircraft. A particular effort was made to keep subject crews from gaining experience with new aircraft prior to this program. To ensure that the crews were current in their original aircraft before the start of the evaluation, a program was completed to assure recent proficiency in their initial aircraft. However, no training or preparation for the new aircraft was permitted.

The crews were then evaluated directly in flight using a "no jeopardy" FAR 61 flight check identical to that used for initial pilot certification. This included normal and non-normal procedures for those maneuvers possible to do in flight. Continuing the check in the simulator, maneuvers were then accomplished for which the environment could not be duplicated in flight, such as for weather, and certain approach types. The primary emphasis here was on non-normal procedures that could not be duplicated or that would be very difficult to safely duplicate in a flight environment.

Finally, a proposed "Differences Training Program" was assessed to identify needs appropriate for a FAR 121 program. Experiences of the subject crews, together with observvations of the evaluators, were examined and these served as the basis for the development of the Flight Standardization Board findings for the common type rating and for "differences training" requirements. The evaluators used in this program were experienced in the particular aircraft type and they were highly qualified in evaluating crew performance during type rating and air carrier proficiency checks with major U.S. air carriers.

The flight evaluation and trial type rating checks consisted primarily of the normal and non-normal maneuvers, such as taxi, takeoff, cross wind operations, systems management, area arrivals, landings, and various types of instrument approaches.

The flight evaluation also included training maneuvers, such as approach-to-stalls and steep turns; and non-normal maneuvers and procedures, such as simulated powerplant failures, emergency descents, aborted takeoff, and rejected landings.

The flight evaluation emphasized areas where there were physical differences between the aircraft. This included items such as examination of visual references in landing due to the difference in the pilot's eye-to-wheel height between the B-757 and B-767, and issues such as taxi geometry which might affect a crew in operation on narrow taxiways or confined ramps.

Powerplant procedures were examined. We did, however, have experience with the use of different powerplants on the same model or aircraft, such as with the DC-8 Series which uses several types of powerplants, although crews that are rated to fly the aircraft have the same type rating.

In each case, results of FAA's evaluation were satisfactory.

A review was completed to ensure that there was a degree of compatability between the procedures that were identified for the B-757 and those identified for the B-767. For example, ILS approach procedures were examined, including the flap settings that would be used at various phases of the approach to ensure that there would not be an incompatability between the aircraft when line crews switched aircraft.

The standards used for the flight evaluation phase of the program, and for the simulator phase, included the standard criteria that are applied to FAA type rating or proficiency checks, and are described in references such as the type rating flight test guide. They include parameters such as the performance of maintaining heading within plus or minus 10 degrees, altitudes within plus or minus 100 feet, airspeeds within plus or minus 10 knots. These included the same planning and judgment items that would be appropriate for proficiency or type rating checks.

The next phase of the evaluation program included simulator evaluations of the normal and non-normal procedures, particularly emphasizing those that are not easy to duplicate in flight; for example, adverse weather conditions, performing types of instrument approaches for which facilities were not located in the immediate area of the test program. Non-normal procedures evaluations, some of which are only possible to duplicate with a degree of fidelity in the simulation environment, included multiple hydraulic failures; flight control system failures or asymmetries; pressurization failures or degradation of performance of other systems in the aircraft; smoke and fire and associated procedures; severe engine failure, fire, or damage; and complete electrical failure.

Some of these non-normal procedures were purposely completed with the checklist from the opposite aircraft so as to ensure safe performance of these maneuvers if the wrong procedure was followed. It was found that even in this case, the crews could safely and effectively perform the necessary maneuvers and safely land.

Following the flight simulator evaluation portion of the program, we entered a phase where we completed a trial "differences training" program to identify the candidate differences between the B-757 and B-767 that would be suitable for incorporation in FAR 121 training programs. This "differences training" would be completed prior to the time that crews would operate these aircraft. The "differences training" program was provided to the subject candidates as well as to the evaluators, comments were taken, and the requirements for FAR 121 differences training program were then established.

The Flight Standardization Board then took the results of the flight evaluation program, the simulator evaluation program, and the trial differences training program; reviewed the information that had been taken to that point, including the technical material that had been submitted by the manufacturer; and came to the conclusion that a common type rating was appropriate for the B-757 and B-767 aircraft.

They subsequently: (1) set the "differences training" program requirements for FAR 121 operators, that included items such as the separate emergency training requirements for each aircraft; (2) specified the minimum number of hours of training that would be required to be given for the systems; and (3) determined that common simulators, initial operating experience, recency of experience, line checks, and proficiency checks could be used for both aircraft, and separate checks would not have to be given for each aircraft.

The Flight Standardization Board's findings were submitted, approved by FAA Washington Headquarters, and were implemented by providing the information to the FAA Aeronautical Center in Oklahoma City, which serves as the clearinghouse for administratively processing type ratings. The findings were distributed to FAA Air Carrier District Offices and Flight Standards District Offices around the country for use by Principal Operations Inspectors when they approve the training programs and operations specifications of their respective carriers. In addition, we have now had approximately a year of successful experience with this program. FAA inspectors who have been dual-qualified in both these aircraft have been taking advantage of the provisions of common type ratings in the normal work programs.

In summary, we believe that this program was a thorough, very successful program, and we are quite confident that the common type rating will be successfully applied by the air carriers in the near future. ††

SPECIAL TOPIC:

[EDITOR'S NOTE: This article has been provided by Neil Schalekamp, Aerospace Engineer, Transport Standards Staff, FAA, Northwest Mountain Region.]

NEIL SCHALEKAMP

Silent Skies

The skies around airports are not quite silent, but the sounds generally are becoming less annoying even with more aircraft operations. For example, the whine and roar of older aircraft designs (DC8, B707, BAC1-11, etc.) is being replaced by the "whoosh" of modern day high by-pass ratio engine powered airplanes. The technological advances in engine and aircraft designs that have promoted fuel efficiency in most cases, have produced quieter airplanes.

As of January 1, 1985, certain noisy aircraft models have been "grounded" by Federal Noise Regulations. A brief history of how we arrived at this point is the subject of this article.

In 1968, the Federal Aviation Act of 1958 was amended to require that the FAA Administrator prescribe regulations for the control of aircraft noise and sonic booms. The amendment vests ultimate responsibility for control of noise at the source -- the airplane itself -- directly with the FAA. This Congressional act and the National Environmental Policy Act of 1969 (which affects every Federal agency) formed a broad legislative base for the FAA environmental regulations that followed.

As a result of that effort, FAR Part 36 (14 CFR Part 36) was promulgated in 1969. Part 36 is a complex regulations concerning aircraft noise certification which sets forth specific criteria for conducting aircraft noise certification tests and noise data corrections. A noise measurement unique to aircraft noise certification, Effective Perceived Noise Level (EPNL), was created to account for perceived annoyance from broadband noise levels and tones created by aircraft engines and to account for the duration of the aircraft flyover event.

This regulation established noise level standards for airplane type designs. The existing airplane designs were constrained by what came to be known as the "parent noise limit," or "Stage One" noise level limits. Basically, those existing airplanes were determined to be as quiet as was technologically practical and economically reasonable. They may not be modified in any way that makes them noisier than their "parent" (which in most cases is itself).

Part 36 also established noise level standards for new airplane type designs applied for after 1966 and not approved as of December 1969. These levels became known as "Stage Two" noise levels. The effect of this provision was to "clamp a lid" on new designs to ensure that the engine and airplane contained noise reduction design features.

In 1977, the regulation was amended to define a more demanding noise level limit, "Stage Three" noise levels, for new type designs applied for after November 1975.

All this was progress, of course, for controlling the noise of new type designs; but older, noisier (Stage One) aircraft were still being produced since their type designs were approved long before the issuance of Part 36. As was pointed out above, these airplanes could not escalate their noisiness due to the "Stage One" noise limit, but a means was sought to prevent the continued production of these models.

An amendment to Part 36 in 1973 addressed this situation by controlling the issuance of Airworthiness Certificates. An Airworthiness Certificate is required for each individual airplane that is produced by a manufacturer to indicate its compliance with the aircraft type design. The amendment required that airplanes being manufactured after December 1973 (December 1974 for business jets and JT3D-powered turbojets) conform to the "Stage Two" noise level standards before an original airworthiness certificate could be approved.

This provision of Part 36 is referred to as the "newly produced rule" and it effectively stopped continued production of "Stage One" airplanes, such as the B707 and DC8 airplanes; early versions of the DC9, B727, and B737 models; and some business jets.

Now that new airplane designs and the production of older aircraft designs were constrained to comply with the "Stage Two" noise level standards. "Stage One" airplanes -- those older designs that were produced prior to 1974 and were still being operated -- were addressed in an amendment to FAR Part 91 (91-136), known as Subpart E, "Operating Noise Limits."

Subpart E of Part 91 was adopted in December 1976 and required that in January 1985 operation of large (maximum certified takeoff gross weight of more than 75,000 lb.) turbojet-powered civil airplanes cease in U.S. airspace unless those airplanes comply with the

Special Topic Continued...

"Stage Two" noise level standards of Part 36. Certain operators, such as air carriers, were required to phase into compliance starting in 1981. This operating noise rule affects most older large turbojet-powered airplanes, including the B707, DC8, and early production models of the DC9, B727, and B737 that did not incorporate acoustic treatment in the engine and nacelle designs.

Subpart E of Part 91 is somewhat unique in that it requires "Stage One" airplanes to be recertified to "Stage Two" in order to continue operating after 1984.

Exemptions to extend the time limit for compliance are possible. In fact, Subpart E of Part 91 offers the "Small Community Exemption" for twin engine airplanes with 100 passenger seats or less. This exemption is available to an operator "for the asking" (irrespective of the size of the community served) and was intended to preclude the elimination of air service to small communities by extending the required compliance time to January 1988. In many cases, small communities are served by regional air carriers that use primarily the older twin engine airplanes that do not comply with the "Stage Two" standards. Approximately 350 "Stage One" DC9's, B737's, and BAC1-11's are operating under the "Small Community Exemption."

Other exemption routes are available to operators of non-complying three- and four-engine turbojet airplanes. Of course, the general exemption provision of Part 11 is available and, in fact, has been used successfully by over a dozen operators of non-complying four-engine airplanes (i.e., DC8's and B707's).

In October 1984, Congress passed the Chiles Amendment, introduced by U.S. Senator Chiles of Florida, which specifically addresses the issue of foreign air commerce at two specific airports -- Miami, Florida; and Bangor, Maine. The Chiles Amendment offers operators of "Stage One" four-engine airplanes specific means to obtain exemptions from the deadline for compliance based on the fact that, as 1985 approached, "Stage Two" quiet nacelle retrofit hardware was not available for installation. Over twenty operators have received exemptions under the provisions of the Chiles Amendment. Nearly 100 "Stage One" four-engine airplanes are operating as a result of exemptions and court-ordered stays against FAA enforcement actions.

Whether the general exemption provisions (Part 11) or those available under the Chiles Amendment are used, the FAA evaluates the following five factors:

1. Is the operator a smaller air carrier?

2. Has the operator made a good faith compliance effort?

3. Is the needed technology delayed or unavailable?

4. Will compliance with the 1985 deadline cause the operator financial havoc?

5. Will the cessation of air carrier service deprive the public of valuable airline service?

Presumably, if the answers are all yes, the operator stands a good chance of securing an exemption and thereby will be able to operate non-complying airplanes until the time when the hardware is available. Recently, the FAA has defined more clearly what each of these five requirements entail, and has provided exemptions to "essential air service carriers."

Speaking of technology, most of the older large two- and three-engine turbojet-powered airplanes (primarily JT8D-powered fleet) do have technology available to become "Stage Two" airplanes, namely, acoustically treated engine nacelles. Most of these airplanes (B727, B737, DC9, etc.) either have been upgraded to meet the "Stage Two" standards, or have been passed on to foreign operators and are not operated in U.S. airspace.

The operators that appear to be in dire straits are primarily the operators of the JT3D-powered fleet --mainly DC8's and B707's. The only "Stage Two" technology available to these operators, as of January 1985, is the CFM engine retrofit of the DC8. While this modification is very effective in meeting the noise level requirements and provides a vast improvement in fuel economy, it is relatively costly for these older jets.

However, as the January 1985 compliance date approached, several aircraft modifiers initiated programs to develop and install quiet nacelles (Q.N.) on DC8's, B707's, or C880's in hopes of meeting the "Stage Two" limits. By the end of 1984, ten applicants had applied to the FAA for Supplementary Type Certificate (STC) approvals on 14 various projects regarding these models. On February 22, 1985, the first one of these applicants, Shannon Engineering Company, obtained an STC for the installation of quiet nacelles on the B707-300 model. The other applicants are continuing their efforts in hopes of also securing an STC.

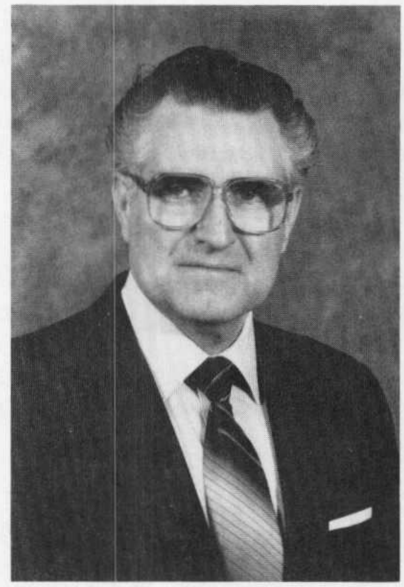
The evolution of regulating the "Stage One" airplanes out of existence, at least in the United States, by controlling the type design requirements (Type Certificates), production requirement (Airworthiness Certificates), and operating requirements (Part 91), is supported by most and may have established procedures for the eventual demise of "Stage Two" airplanes.

As was pointed out earlier, applications for type design approvals since 1975 have had to meet the more stringent "Stage Three" noise level requirements. Furthermore, the FAA is presently considering a petition to amend Part 36 and Part 91 to prevent continued production and operation of "Stage Two" airplanes. It should be pointed out, however, that any regulatory action taken must be economically reasonable and technologically practicable. While "Stage Three" may be within the reach of current technology, the economic penalties of forcing this standard on the DC10, B747, etc., may currently outweigh the benefits.

So the skies have become quieter around many airports by controlling aircraft noise at its source -- the airplane -- and by employing noise abatement flight procedures where possible. FAA efforts have recently diverged into another area of noise control: land use planning around airports (FAR Part 150). But that's another story for another time! ††

NRS CORNER

EDITOR'S NOTE: The FAA's National Resource Specialists (NRS) serve a very important function within our organization. Our NRS for Fracture Mechanics/Metallurgy has submitted the following article to explain his involvement and activites in his area specialty.



TOM SWIFT

Damage tolerance technology, a means for providing structural safety in the event of accidental, corrosive, or fatigue-induced damage, is in an important stage of evolution in the commercial aviation industry.

Currently, out of four FAA Directorates, only the "Transport Airplane Certification Directorate" has incorporated a requirement for damage tolerance evaluation within their regulations. This requirement is outlined in FAR 25.571. However, the Rotorcraft, Engine and Propeller, and Small Airplane Certification Directorates are now also in the process of including a damage tolerance philosophy into their requirements.

In order to achieve successful damage tolerance evaluations, however, it is essential to encourage the development of analytical fracture mechanics within industry. Existing fatigue methods, such as the linear cummulative damage approaches, cannot predict residual strength as a function of time and cannot, therefore, be used rationally in a damage tolerance evaluation.

The National Resource Specialist (NRS) for fracture Mechanics/Metallurgy, Tom Swift, sees the encouragement of fracture mechanics development as his major challenge for the near future.

This challenge is not new for Tom and reaches back to the early 1970's when the U.S. Air Force was trying to incorporate damage tolerance into the design of fixed wing military aircraft. During this period Tom, as the head of fatigue and fracture mechanics research at Douglas Aircraft, served on the AIA committee which reviewed and rewrote the Air Force damage tolerance requirements, MIL-A-83444. At that time, Tom admits to being reluctant to accept a regulation which would incorporate these new and evolving scientific methods. However, in accepting the challenge, he was able to convince his management to increase Research and Development spending by 20 to 1 over a short period of time in order to develop a capability in fracture technology, which is currently believed by the Air Force to lead the industry.

NRS continued...

Tom left his position at Douglas in 1980 to become an FAA National Resource Specialist in order to accept the challenge of attempting to encourage the development of a damage tolerance philosophy throughout the aviation industry at home and abroad.

Working as an advisor to the Transport Airplane Directorate, Tom has reviewed analytical methodology used for every aircraft currently being evaluated to the new damage tolerance regulation. These aircraft are the B-767, B-757, CL-600, BAe-146, SF-340, DHC-8, EMB-120, ATR-42, CN-235, Israeli Westwind 1125, G4, Falcon 900, and A-310. This work has included advice to both domestic and foreign manufacturers, as well as to foreign authorities.

Although damage tolerance has been with the Transport Directorate since December 1978, the challenge of incorporating this philosophy into regulatory policy continues: Modifications performed on aircraft which were certified under FAR 25.571 will require damage tolerance evaluations. These modifications, which often incorporate major design changes, are usually performed by small modifiers who probably have not yet developed a capability in analytical fracture mechanics. This applies especially to DER's.

Thus, Tom suggests further encouragement of the development of fracture technology within the body of Designees to which this newsletter is addressed.

Tom Swift is attempting to assist the Rotorcraft Directorate in a number of ways. The Air Force has recently awarded a contract to Sikorsky to perform a damage tolerance evaluation on the HH53C helicopter as a feasibility study. Prior to his present assignment with the FAA, Tom assisted the Air Force as a damage tolerance advisor and member of steering committees for KC-135, C5, and A10 aircraft, as well as being responsible for the KC-10 damage tolerance evaluation at Douglas. With this background, he was asked to participate in the steering acitivity on the damage tolerance evaluation of the HH53C helicopter, the first such evaluation to be made.

The primary purpose of this was to obtain first-hand information on the feasibility of managing the safety of dynamic components through a damage tolerance philosophy.

Tom was asked by Dr. Jack Lincoln, Air Force Technical Advisor on Structural Integrity, to sit on a panel at a recent American Helicopter Society Fatigue Specialist meeting. The theme of the discussion was, "Should the helicopter industry espouse the damage tolerance philosophy?" Tom made a slide presentation at this meeting before most of the helicopter manu-damage tolerance philosophy within the fixed wing industry. This presentation was designed to encourage development of a damage tolerance philosophy within the rotorcraft industry. Since this meeting, Tom was asked by Sikorsky technical personnel to make a similar presentation on damage tolerance development within the fixed wing industry to Sikorsky management.

A worthwhile point to mention is that the rotorcraft industry is already using a damage tolerance philosophy for design approach to protect the safety of a number of machines. These machines, after experiencing fatigue problems in service, are being inspected through airworthiness directive (AD) action where inspections are based on crack growth and residual strength evaluations. This is damage tolerance.

NRS continued...

Tom has assisted the Engine Directorate on a number of occasions by visiting all major engine manufacturers for discussions on damage tolerance issues. He recently made a slide presentation, designed to encourage damage tolerance in engines, to an Engine Damage Tolerance Workshop, organized by Dan Salvano, NRS for engine dynamics, and sponsored by the Engine and Propeller Directorate. As a result of these discussions, one engine manufacturer is already using the Air Force's in-service non-inspectable damage tolerance philosophy to design engine mount systems.

A similar story exists with the Small Airplane Directorate, and Tom has been encouraging manufacturers of small aircraft to incorporate damage tolerance principles in their designs. In fact, he performed damage tolerance evaluations for the Citation III fuselage under contract while still at Douglas. The Small Airplane Directorate has recently proposed to incorporate a damage tolerance philosophy as part of its FAR 23 regulatory review program.

Although many small airplane manufacturers have resisted damage tolerance by regulation, one manufacturer has already issued a maintenance manual incorporating inspection frequencies based on fracture technology.

Tom has lectured at such universities as M.I.T., Purdue, U.C.L.A., Long Beach State, and San Diego State, on the subject of damage tolerance.

As a member of the fatigue committee for the Engineering Sciences Data Unit of the Royal Aeronautical Society, Tom reviews fatigue and fracture mechanics data items prior to publication. He is a member of the Industry Coordination Committee for MIL-HDBK-5 and was chairman of the Task group which laid the foundation for crack growth data published in MIL-HDBK-5. He is a member of the Institution of Mechanical Engineers, a Royal Chartered Engineer, a member of the Council of Engineering Institutions in the United Kingdom, and a registered member of the Association of Professional Engineers of Ontario, Canada.

He has published papers on the subject of damage tolerance philosophy and has lectured on the topic in Canada, Sweden, the Netherlands, France, Germany, Belgium, Portugal, the United Kingdom, and the United States.

Tom has been assigned by FAA Headquarters to develop a training course in fracture mechanics for FAA engineers, and this has now become a major goal.

The course, entitled "Stress Analysis Oriented Fracture Mechanics and Phase I," which includes the development of fundamentals and residual strength, is now complete. This course was presented by Tom in February 1985 at the FAA Regional Office in Seattle and an attempt is being made to present the course at each major Aircraft Certification Office. Information concerning the availability of this course was released recently at a Rotorcraft Directorate DER meeting in Fort Worth, and immediately the DER's indicated that they were interested in sitting in on the course. Hopefully, this can be arranged, and the Southwest Region is currently working on it.

Final Note: If any Designee reading this article needs more information on damage tolerance or thinks Tom Swift can help him in any way, he is invited to call Tom at (213) 548-2661. ††